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## CALCULUS.

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161. Proposed by J. C. NAGLE, M. A., M. C. E., Professor of Civil Engineering in the Agricultural and Mechanical College of Texas, College Station, Texas.

A cylindrical oil tank of length  $l$  and radius  $r$  is capped by curved ends and rests with the axis horizontal. The total axial length of tank is  $l+2h$ . If the oil stands at depth  $d$  in the tank ( $d$  less than  $2r$ ) find its volume ( $a$ ) when the ends are portions of the surface of a sphere, ( $b$ ) when the ends are portions of the surface of an ellipsoid.

A special case of the above problem was recently received from Houston, Texas, for solution. It is passed on to the readers of the MONTHLY.

162. Proposed by J. E. SANDERS, Hackney, O.

Solve the differential equations

$$(a) \ x \frac{dy}{dx} - y = x\sqrt{(x^2 + y^2)}, \quad (b) \ \cos x \frac{dy}{dx} + y = 1 - \sin x.$$

## MECHANICS.

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151. Proposed by W. J. GREENSTREET, M. A., Editor of The Mathematical Gazette, Stroud, England.

An elastic ball is projected along a horizontal tube, striking first the bottom, then the top, then the bottom, and so on. Find the number of times the ball will strike the top.

152. Proposed by F. P. MATZ, Sc. D., Ph. D., Professor of Mathematics and Astronomy in Defiance College, Defiance, Ohio.

A ball of lead an inch in diameter is cast into a ball of rubber two inches in diameter so as to be internally tangent. What is the nature of the path made by this *lead-rubber* ball in rolling down an inclined plane?

## DIOPHANTINE ANALYSIS.

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112. Proposed by L. C. WALKER, A. M., Graduate Student, Leland Stanford Jr. University, Cal.

There is a series of rational triangles whose sides have a common difference of unity. Calling the one whose sides are 3, 4, 5, the first triangle, find the sides of the  $n$ th triangle.

## AVERAGE AND PROBABILITY.

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136. Proposed by L. C. WALKER, A. M., Graduate Student, Leland Stanford Jr. University, Cal.

By direct computation find the average distance between two points in the surface of a given rectangle, but on opposite sides of a diagonal.

137. Proposed by G. H. HARVILL, Malakoff, Texas.

$A$ ,  $B$ ,  $C$ , and  $D$ , in playing whist, agree that the person who first cuts an ace shall have a stake of \$313. What is the value of each person's expectation before the play begins, each taking his turn at cutting in the order named as the game progresses?